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Featured News Story

The Week at Roger

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4-23-2021

## **Celebrating Student Research and Academic Projects at SASH**

Anna Cohen

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BRISTOL, R.I. – At the eighth annual Student Academic Showcase and Honors (SASH) on Wednesday, undergraduate and graduate students shared their academic accomplishments with the RWU community. Students presented academic research, Honors Capstone Projects, panel discussions, arts performances, and other scholarly and creative endeavors.

"One of the most exciting things to happen at a university is the creation of new knowledge," said RWU President Ioannis Miaoulis. "SASH is a day celebrating scholarship for the University. It gives an opportunity for students and faculty to go around and see all the creative work from this year."

For the first time, RWU canceled regular class meetings during SASH to prioritize community participation. Students attended presentations, discussed research, and asked questions of their peers.

"It's fantastic to see such an incredible variety of projects," said Provost Margaret Everett. "It gives me a lot of pride to see what the students have been able to do this year, and to hear them talk about their passions."

Here is a sampling of the many creative academic projects shared at SASH 2021:

### Calibrating an Algal Alert Sensor

Sarina Olson, Junior Electrical and Computer Engineering major from Bristol, R.I., presented her work on improving the design of a submersible fluorometer, a device used to detect dangerous algal blooms. Olson's results found the device to be able to differentiate between two algal groups using light.

### Evaluating A Public Health Program

The [Bristol Health Equity Zone](#), a Rhode Island Department of Health initiative to promote local health, made its in-person cooking demonstrations virtual due to the COVID-19 pandemic. Samara Pinto, senior Psychology major from Maynard, Mass., evaluated the virtual cooking program to determine its effectiveness.

She began interning with the Bristol Health Equity Zone in the winter of 2021, and plans to continue her involvement throughout the summer.

"My long-term goal is to work for the Department of Health in Rhode Island, so this was a really neat way to learn about my own community and its needs," said Pinto.



Samara Pinto, senior Psychology major from Maynard, Mass., with her poster "Program Evaluation of the Bristol Health Equity Zone Cooking Demonstrations."

An App For Interactive Digital Presentations

Senior Computer Science majors Nicholas Ferreira, Peter Navarro and Michael Pieper created Varro, an app that expands the function of digital communication. Varro provides more options for interactive video calling, a need the team recognized from the reliance on virtual connection through the COVID-19 pandemic.

"Viewers can focus on a part of the screen, zoom in, or tell the presenter to speak up non-verbally. The key purpose is to make digital presentations and communication more fluid, less clunky, and more personable," Ferreira said.

"In the software development world, you are always working in a team, coding for two weeks, meeting, seeing how everything runs, and going from there. Spending a full year on a project with the same group of people is what we would do in the workforce. Instead of just being given directives and having to follow them to the T, we had to decide how we would create what we did, so I think this is a very applicable project," said Pieper.



Senior Computer Science majors Nicholas Ferreira, Peter Navarro and Michael Pieper with their poster "Varro: A System that Allows a Remote Viewer to Direct Where a Presenter 'Aims' Their Phone Camera."

Architecture For Community Development





Justine Aho, senior Architecture major from Pelham, N.H., presented her Honors Capstone Project, "Center of Culture, Creation, and Expression," a semester-long architectural design studio project in which she designed an arts center in Boston, Mass.

"Going forward, I really want to focus on large projects like this that benefit the public sphere," said Aho. "I want to focus on the diverse groups of people who live in or visit a city, and I think this project really did that. Art is so important, regardless of your background. Whether you are an Architecture major like me, an Engineering major, an Arts major, no matter what you are learning, art is important for developing your cities and creating a sense of

community. This art center encourages people to engage with art and the benefits it provides."



Justine Aho, senior Architecture major, designed this arts center for her Honors Capstone Project, "Center of Culture, Creation, and Expression."

#### Child Development Through Athletics

Senior Educational Studies major Sebastian Suarez, from West Hartford, Conn., is on the path to becoming an Athletic Director. He researched the benefits of exercise for middle-school aged children and designed an athletic program to keep them moving.

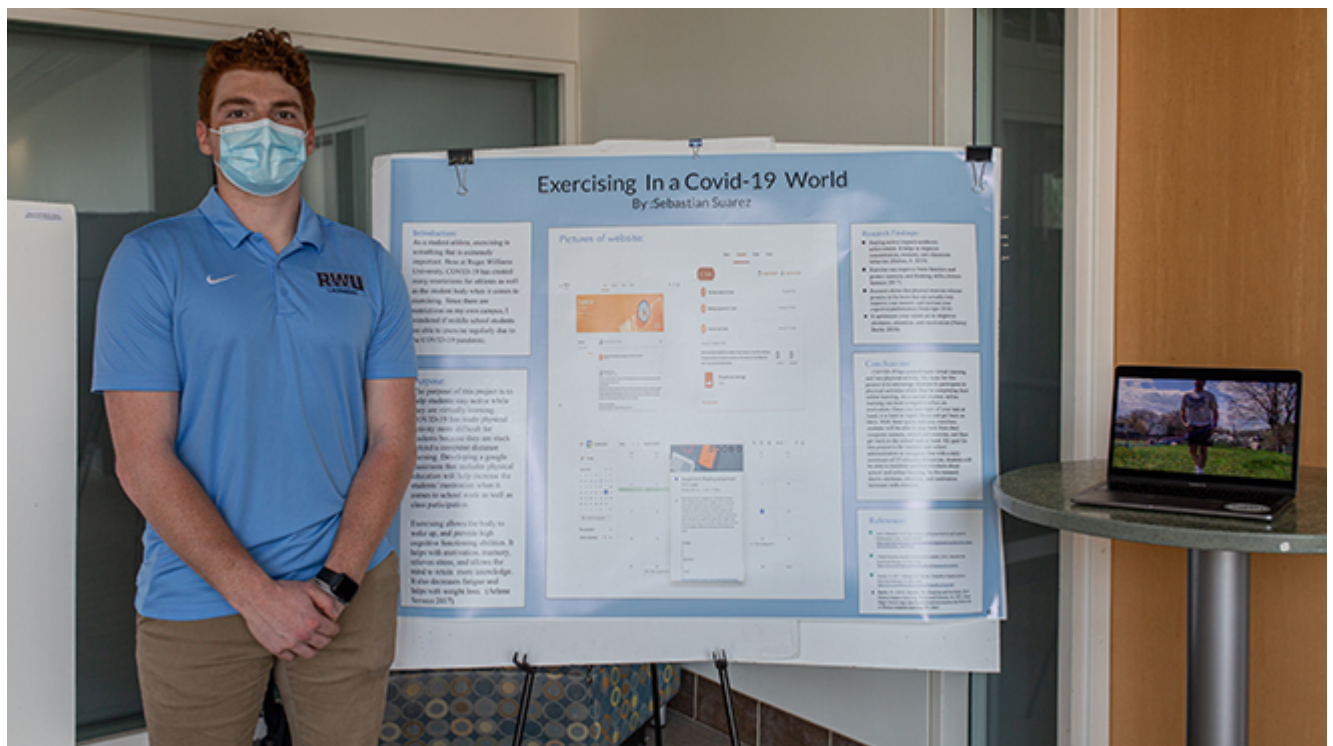
"I was wondering what happens to students in the lower grades, who are in such a crucial developmental stage, when they have to do remote education. A lot of them are just in front of their

computer screens all day, not really doing anything else," said Suarez. "Exercising helps them wake up their brain and help them focus on their task at hand."

He designed five 15-minute workout videos to be shared through Google Classroom to meet exercise requirements and improve student motivation.

"Down the line, I hope to implement this program in the school I work for," said Suarez.

Suarez will attend Rider University's Masters in Athletic Leadership program after graduating.



Senior Educational Studies major Sebastian Suarez, from West Hartford, Conn., with his project "Exercising In a Covid-19 World."

A Pizza Delivery Robot



Senior Engineering Majors Tim Beaulieu, Joe Gaudio, Joseph Hogan, Eamon McKenney and Logan Souza developed a "Pizza Delivery Robot," a machine capable of securely driving a full pizza across campus, for their Senior Design project. They set up their robot on the Library Quad to provide demonstrations for curious spectators.

#### Reducing Cybercrime Targeting College Students



Senior Criminal Justice major Natalia Villareal, from Feeding Hills, Mass., wanted to help her peers reduce their risk of cybercrime victimization through education.

For her Honors Capstone Project, Villareal researched the online habits of college students, and studied the effects of preventative measures on reducing crime risk, along with the impact of cybercrime on her community.

"I really was able to begin to understand the vulnerabilities of the college population in terms of cybercrime victimization," said Villareal. "I was able to understand the ways they expose themselves on a daily basis and the ways this contributes to them feeling unsafe online. I really want to draw attention to the fact that people might not even realize the ways they are exposing themselves. They might not understand that their data is vulnerable. It is my hope that bringing awareness to this type of thing will help mitigate this risk."



Senior Criminal Justice major Natalia Villareal, from Feeding Hills, Mass., presents her Honors Capstone Project "Fear of Cybercrime and Victimization."

Advising Young Investors

Senior Finance and Economics major Emily Gildea, from Palos Park, Ill., presented her Honors Capstone Project "Educating Retail Investors in a Volatile Market."

While working last summer in RWU's [Center for Advanced Financial Education](#) (CAFE,) Gildea got first-hand experience investing real money in 2020's unpredictable stock market. She began to wonder why so many new investors were entering the market while it was responding to the pandemic, and set out to answer this question through her research.

"I wanted to be able to educate the people I am surrounded by. I am a young investor, and a lot of people in my classes are as well. I wanted to be able to break down what happened in 2020 so that people could understand it and have a better idea of what to do in the market moving forward, and to make better educated decisions about their investments," said Gildea.



Senior Finance and Economics major Emily Gildea, from Palos Park, Ill., presents her Honors Capstone Project "Educating Retail Investors in a Volatile Market."

### Showcasing Music

The day ended with SASH's Music Showcase, where student musicians shared their talents with the campus community.

Sophomore Music and History major Lindsey Whitehead, from Glenview, Ill., performed Sonata No. 1 in F Minor, Op. 2, No. 1, I. Allegro by Ludwig van Beethoven on the piano.

"Beethoven is a very intimidating composer who creates equally intimidating works. What's written on the page and technique can only bring you so far when playing a Beethoven sonata. You have to have



to approach it with passion and gusto," said Whitehead.

Senior Communication & Media Studies major and Music minor Zuri Soto, from Shelton, Conn., chose to sing "Corner of the Sky" from the musical *Pippin* due to its emotional content and her connection to the piece.

"Performing this piece meant a lot to me as a senior because it was able to capture my personal journey while having an emphasis on my future goals. Even though I have accomplished a great deal during my four years at Roger, I am prepared to use my talents and knowledge in the next chapter of my life," said Soto.

SASH 2021

[Previous](#)







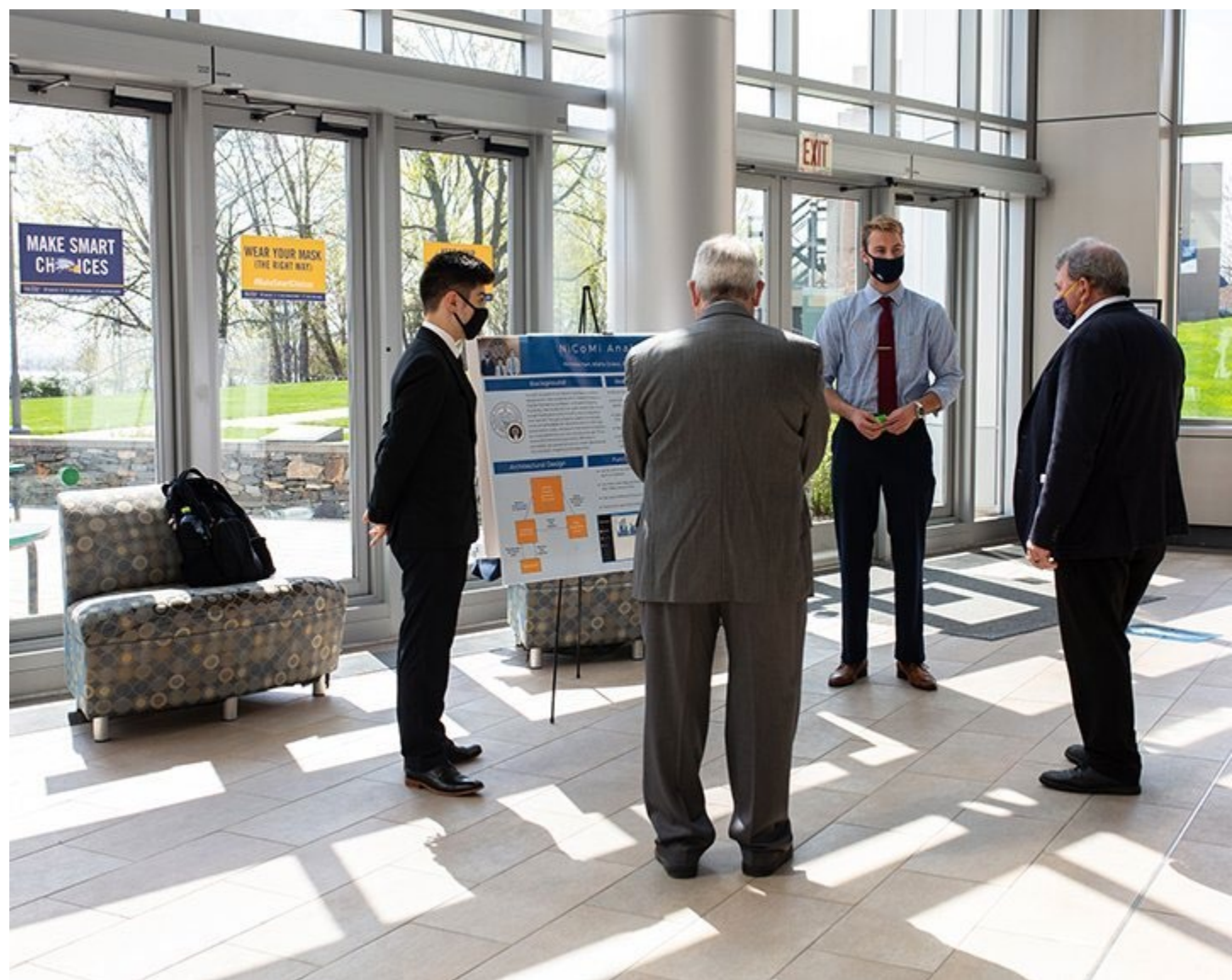
















# COVID-19 Pandemic Volterra Integral Equation

Enrica D'Amico and Anna Krasovskaya  
Department of Mathematics, Roma Tre University, Rome, Italy

## Introduction

The COVID-19 pandemic has affected many people throughout the world. It is a global health crisis. The objective of this research project is to find a numerical solution through the Volterra Integral Equation of the second kind. The Volterra Integral Equation of the second kind is used to capture a broader range of disease distributions. The mathematical model of this Volterra Integral equation will yield convergence results for the COVID-19 data for Italy. The modeling of this theory will be done using the Galerkin method, inspired by the numerical approximation using the Gaussian Quadrature nodes. Inspired by the COVID-19 pandemic, the model will include the number of initially infected individuals, the rate of infection, contact rate, death rate, fraction of recovered individuals, and the mean time an individual remains infected.

## Volterra Integral

The nonlinear-gaussian Volterra integral equation of the second kind is used, where  $\phi(x)$  is the kernel of the integral equation, and  $\lambda$  is a parameter.

$$\phi(x) = f(x) + \lambda \int_0^x K(x,t)\phi(t)dt$$

## Galerkin and Gaussian Quadrature Methods

We approximate the integrals by a sum by using the Galerkin Method, in the area of approximation is simpler, in order to use the Galerkin Method, we first convert the original integral to an integral bounded from 0 to 1. The Gaussian Quadrature method with 7 nodes works as follows:

$$\int_0^1 f(x)dx \approx \sum_{i=1}^7 w_i f(x_i)$$

Then the Galerkin Method applied:

$$\int_0^1 f(x)dx \approx \sum_{i=1}^7 w_i f(x_i)$$

where  $\phi(x) = f(x) + \lambda \int_0^x K(x,t)\phi(t)dt$  and  $\lambda$  and  $x_i$  are given as follows:

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## Italy

A quartic fit was used to fit a curve to the number of infected, number of deaths, and number of recovered people for Italy. By using a quartic fit, the three fitted curves each had an  $R^2$  value of 0.99, and the standard error was less than 0.0001. From these three curves, the six variables were calculated and found. The Number of Cases vs Time plot was used to find  $I_0$ ,  $R_0$ , and  $R$ , where  $R$  is just the average of the derivative of  $I(t)$ . The Number of Deaths vs Time plot was used to find the variable  $b$  by taking the average of the derivative from the given fit. Lastly, the Number of Recovered vs Time plot was used to find  $P(t)$  which is the equation for the line of fit. It was found afterwards using  $P(t)$  and  $b$  that were already found.

$$I(t) = 9 \text{ What we are solving for}$$

$$t = \text{The amount of days after February 13, 2020}$$

$$I_0 = 4.4616 \times 10^{-4}$$

$$R = 4.666 \times 10^{-4}$$

$$I(t) = 2.58t^4$$

$$b = 4.124 \times 10^{-4}$$

$$P(t) = 0.00126 - (1.59 \times 10^{-13})t + (5.17 \times 10^{-13})t^2 - (4.89 \times 10^{-13})t^3 + (1.78 \times 10^{-13})t^4 - (2.15 \times 10^{-13})t^5$$

$$P(t) = 0.00126 - (1.626 \times 10^{-13})t + (5.44 \times 10^{-13})t^2 - (5.13 \times 10^{-13})t^3 + (1.867 \times 10^{-13})t^4 - (2.21 \times 10^{-13})t^5$$

$$P(t) = 0.00126 - (1.626 \times 10^{-13})t + (5.44 \times 10^{-13})t^2 - (5.13 \times 10^{-13})t^3 + (1.867 \times 10^{-13})t^4 - (2.21 \times 10^{-13})t^5$$

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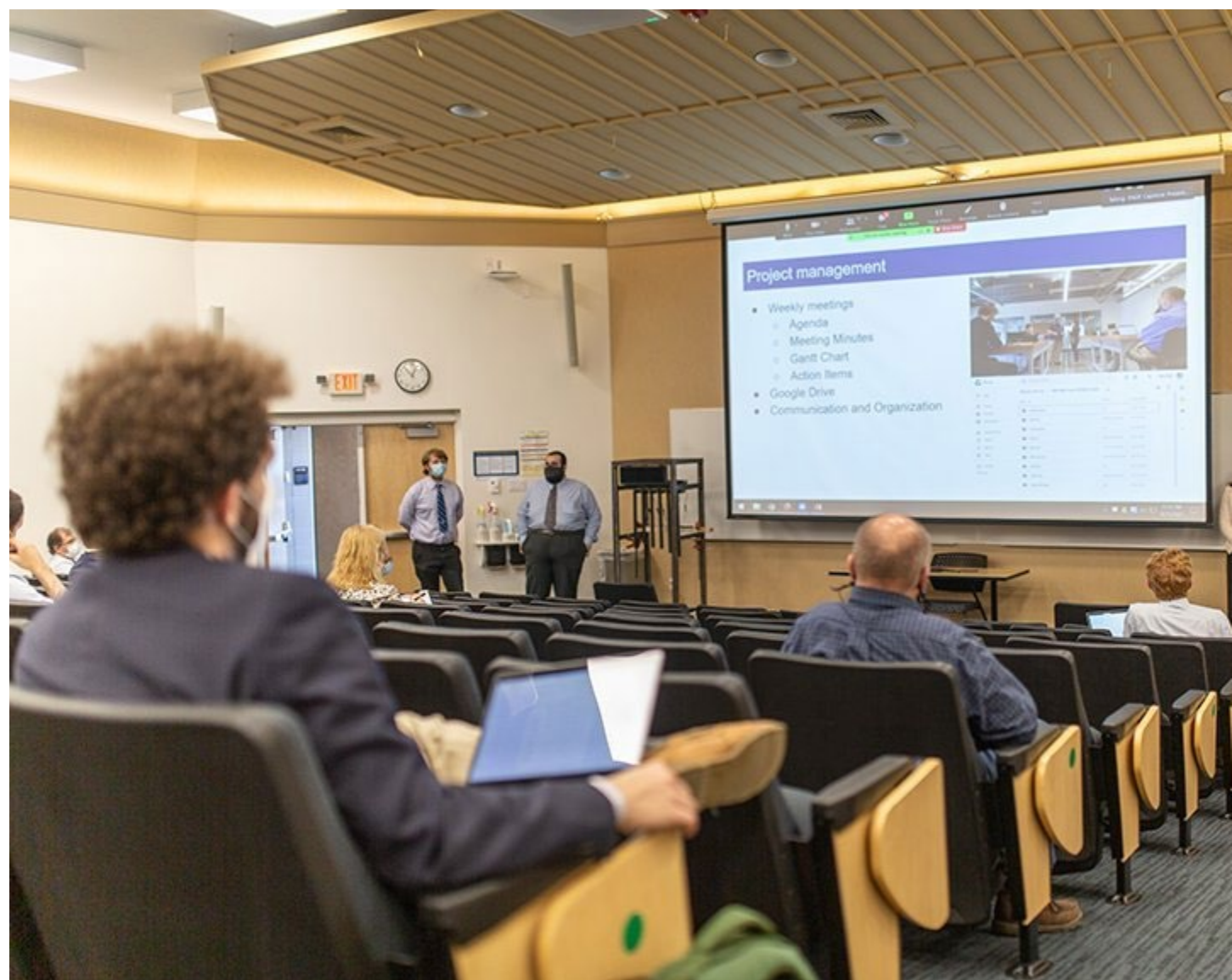
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$$P(t)$$













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# COVID-19 Pandemic Volterra Integral Equation

Enrica D'Amico and Anna Krasova  
Department of Mathematics, Roma Tre University, Rome, Italy

## Introduction

The COVID-19 pandemic has affected many people throughout the world. It is a global health crisis. The objective of this research project is to find a numerical solution through the Volterra Integral Equation of the COVID-19 pandemic. The Volterra Integral Equation of the second kind is used to capture a broader range of disease distribution. The mathematical model of this integral equation will yield convergence results for the COVID-19 data for Italy, health, and economic impact. The mathematical model of this integral equation will yield convergence results for the COVID-19 data for Italy, health, and economic impact.

## Volterra Integral

The nonlinear Volterra integral equation of the second kind is used, where  $x(t)$  is the kernel of the integral equation, and  $\lambda$  is a parameter.

$$x(t) = f(t) + \lambda \int_0^t K(t,s)x(s)ds$$

## Gaussian and Gaussian Quadrature Methods

We approximate the integral by a sum by using the Gaussian Method, in the area of approximation is complex, in order to use the Gaussian Method, we first convert the original integral to an integral bounded from 0 to 1. The Gaussian Quadrature method with 7 nodes works as follows:

$$\int_0^1 f(x)dx \approx \sum_{i=1}^7 w_i f(x_i)$$

Then the Gaussian Method applied:

$$\int_0^1 f(x)dx \approx \sum_{i=1}^7 w_i f(x_i)$$

where  $x_i = \frac{1}{2} \left( \frac{1 + \sqrt{3} \cos \frac{(2i-1)\pi}{14}}{2} \right)$  and  $w_i$  are given as follows:

$$w_1 = 0.22444616, w_2 = 0.22444616, w_3 = 0.22444616, w_4 = 0.22444616, w_5 = 0.22444616, w_6 = 0.22444616, w_7 = 0.22444616$$

$x_1 = 0.0646431, x_2 = 0.22444616, x_3 = 0.37555384, x_4 = 0.5, x_5 = 0.62444616, x_6 = 0.77555384, x_7 = 0.9353568$

The Infected, Recovered, Death (IRD) Model is given below:

$$\frac{dI(t)}{dt} = \lambda \int_0^t K(t,s)I(s)ds - \beta I(t)S(t) + \gamma R(t) - \delta I(t)$$

$$\frac{dS(t)}{dt} = -\lambda \int_0^t K(t,s)I(s)ds + \beta I(t)S(t) - \delta S(t)$$

$$\frac{dR(t)}{dt} = \lambda \int_0^t K(t,s)I(s)ds + \delta I(t) - \gamma R(t)$$

$$\frac{dD(t)}{dt} = \delta I(t)$$

$$I(0) = I_0, S(0) = S_0, R(0) = R_0, D(0) = D_0$$

$$I(t) = \text{Fraction of infected}$$

$$S(t) = \text{Fraction that are initially infected (at } t = 0)$$

$$\beta = \text{Average rate of infection}$$

$$\gamma = \text{Rate of recovery}$$

$$\delta = \text{Average rate of death}$$

$$P(t) = \text{Fraction that has recovered}$$

$$t = \text{Mean time the individual remains infected} = \int_0^t P(s)ds$$

## Italy

It seems it was used to fit a curve to the number of infected, number of deaths, and number of recovered people for Italy. By using a quartic fit, the three fitted curves each had an  $R^2$  value of 0.99, and the  $R^2$  value was less than 0.0001. From these three curves, the six variables were calculated and found. The Number of Cases vs Time plot was used to find  $I_0$ ,  $R_0$ , and  $\beta$ , where  $\beta$  is just the average of the derivative of  $I(t)$ . The Number of Deaths vs Time plot was used to find  $\delta$ . Lastly, the Number of Recovered vs Time plot was used to find  $\gamma$  which is the equation for the line of fit. It was found afterwards using  $P(t)$  and  $\delta$  that was already found.

$$I(t) = \text{What we are solving for}$$

$$t = \text{The amount of days after February 13, 2020}$$

$$I_0 = 4.4616 \times 10^{-4}$$

$$\beta = 4.666 \times 10^{-4}$$

$$\gamma = 2.589$$

$$\delta = 4.124 \times 10^{-4}$$

$$P(t) = 0.00126 - (1.59 \times 10^{-13})t + (5.17 \times 10^{-13})t^2 - (4.89 \times 10^{-13})t^3 + (1.78 \times 10^{-13})t^4 - (2.15 \times 10^{-13})t^5$$

$$I(t) = 0.00126 - (1.626 \times 10^{-13})t + (5.44 \times 10^{-13})t^2 - (5.13 \times 10^{-13})t^3 + (1.807 \times 10^{-13})t^4 - (2.21 \times 10^{-13})t^5$$

$$R(t) = 0.00126 - (1.626 \times 10^{-13})t + (5.44 \times 10^{-13})t^2 - (5.13 \times 10^{-13})t^3 + (1.807 \times 10^{-13})t^4 - (2.21 \times 10^{-13})t^5$$

$$D(t) = 0.00126 - (1.626 \times 10^{-13})t + (5.44 \times 10^{-13})t^2 - (5.13 \times 10^{-13})t^3 + (1.807 \times 10^{-13})t^4 - (2.21 \times 10^{-13})t^5$$

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$$D(t) = 0$$





















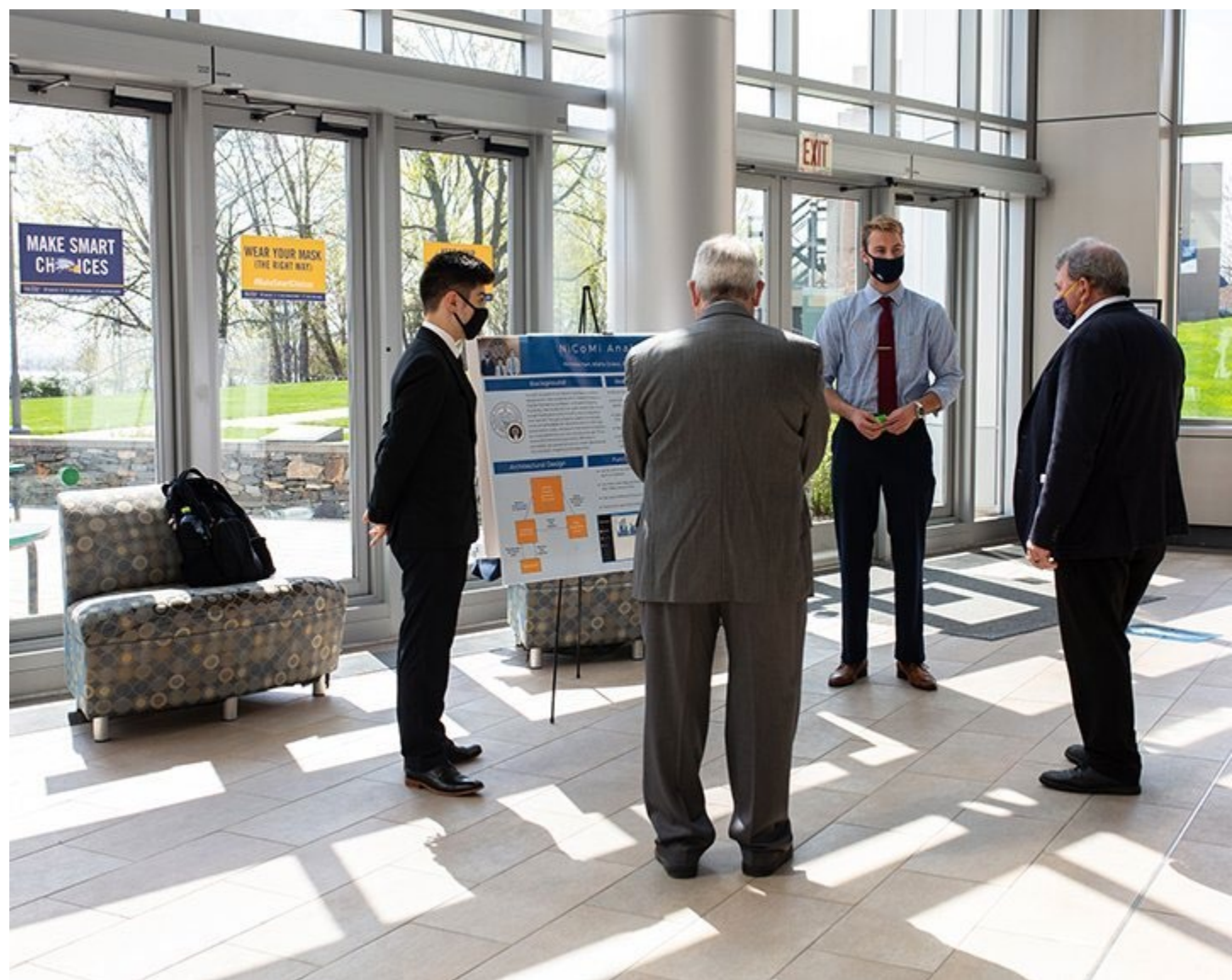
















# COVID-19 Pandemic Volterra Integral Equation

Enrica D'Amico and Anna Krasova  
Department of Mathematics, Roma Tre University, Rome, Italy

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The COVID-19 pandemic has affected many people throughout the world. It is a global health crisis. The objective of this research project is to find a numerical solution through the Volterra Integral Equation of the COVID-19 pandemic. The Volterra Integral Equation of the second kind is used to capture a broader range of disease distribution. The mathematical model of this integral equation will yield convergence results for the COVID-19 data for Italy, health, and economic impact. The mathematical model of this integral equation will yield convergence results for the COVID-19 data for Italy, health, and economic impact.

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We approximate the integrals by a sum by using the Galerkin Method, in the area of approximation is simpler, in order to use the Galerkin Method, we first convert the original integral to an integral bounded from 0 to 1. The Gaussian Quadrature method with 7 nodes works as follows:

$$\int_0^1 f(x)dx \approx \sum_{i=1}^7 w_i f(x_i)$$

Then the Galerkin Method applied:

$$\int_0^1 f(x)dx \approx \sum_{i=1}^7 w_i f(x_i)$$

where  $x_i = \frac{1}{2} \left( \frac{e^{2\pi i k} - 1}{e^{2\pi i k} + 1} \right)$  and  $w_i$  are given as follows:

$$w_1 = 0.1274044662, w_2 = 0.279702803, w_3 = 0.391400008, \text{ and } w_4 = 0.427958037$$

$$w_5 = 0.391400008, w_6 = 0.279702803, w_7 = 0.1274044662$$

The infected, Recovered, Death (IRD) Model is given below:

$$I(t) = I_0 + \int_0^t \left( \frac{\beta I(t-s)S(t-s)}{N} - \gamma I(t-s) - \delta I(t-s) \right) ds$$

$$\frac{dI(t)}{dt} = \beta \left( \frac{I(t)S(t)}{N} - I(t) \right) - \gamma I(t) - \delta I(t)$$

$$I_0 = \text{Fraction that are initially infected (at } t = 0)$$

$$\beta = \text{Average rate of infection}$$

$$\gamma = \text{Rate of recovery}$$

$$\delta = \text{Average rate of deaths}$$

$$P(t) = \text{Fraction that has recovered}$$

$$t = \text{Mean time the individual remains infected} = \int_0^t P(s)e^{-\gamma s} ds$$

## Italy

It seems it was used to fit a curve to the number of infected, number of deaths, and number of recovered people for Italy. By using a quartic fit, the three fitted curves each had an  $R^2$  value of 0.99, and the adjusted  $R^2$  value was 0.985. From these three curves, the six variables were calculated and found. The Number of Cases vs Time plot was used to find  $I_0$ ,  $R_0$ , and  $R$ , where  $R$  is just the average of the derivative of  $I(t)$ . The Number of Deaths vs Time plot was used to find  $\delta$ . Lastly, the Number of Recovered vs Time plot was used to find  $\gamma$  which is the equation for the line of fit. It was found afterwards using  $\gamma$  and  $\delta$  that were already found.

$$I(t) = \text{What we are solving for}$$

$$t = \text{The amount of days after February 13, 2020}$$

$$I_0 = 4.9415 \times 10^{-6}$$

$$R = 4.656 \times 10^{-6}$$

$$R_0 = 2.589$$

$$\delta = 4.124 \times 10^{-6}$$

$$p(t) = 0.00126 - (1.59 \times 10^{-13})t + (5.17 \times 10^{-13})t^2 - (4.89 \times 10^{-13})t^3 + (1.78 \times 10^{-13})t^4 - (2.15 \times 10^{-13})t^5$$

$$r(t) = 0.00126 - (1.626 \times 10^{-13})t + (5.44 \times 10^{-13})t^2 - (5.13 \times 10^{-13})t^3 + (1.807 \times 10^{-13})t^4 - (2.21 \times 10^{-13})t^5$$

Real Number of Infected, Deaths, and Recovered

Real Number of Infected, Deaths, and Recovered

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## Numerical Results

This table shows the actual percentage of people infected for 50, 100, 150, 200, 250, and 300 days, as well as the percentage predicted by the IRD model. The model is also shown.

Number of Days	Actual Percentage of Infected People	IRD Predicted Percentage of Infected People
50	0.00000000	0.00000000
100	0.00000000	0.00000000
150	0.00000000	0.00000000
200	0.00000000	0.00000000
250	0.00000000	0.00000000
300	0.00000000	0.00000000

## Conclusion

The IRD model approximated using the Galerkin method predicts the percentage of people that are infected with an accuracy of 10%.

This model was the potential to accurately model COVID-19 cases in Italy and countries with similar patterns.

## Assumptions and Data

The assumption was made that the initial data was the start of the pandemic was with the peak of the pandemic, which is 2.58 people in Italy, and the cubic function depends on the average value has continued.

The death rate was assumed to follow a cubic function.

The initial data was gathered starting at February 13, 2020.

Gaussian Quadrature  $m=7$  was used to approximate the integrals.

## Future Work

In the future, FORTRAN 77 will be used to work higher number of Gaussian Quadrature nodes should be more accurate for any time,  $t$ .

The model will be extended to the whole world, the COVID-19 infection cases down.

## References

- Centers for Disease Control and Prevention. 2020. "Coronavirus Disease 2019 (COVID-19)." <https://www.cdc.gov/coronavirus/2019-ncov/index.html>. Retrieved from: <https://www.cdc.gov/coronavirus/2019-ncov/index.html>.
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## Project management

- Weekly meetings
  - Agenda
  - Meeting Minutes
  - Gantt Chart
  - Action Items
- Google Drive
- Communication and Organization



Task	Assignee	Due Date	Status
Task 1	John Doe	2023-10-25	Completed
Task 2	Jane Smith	2023-10-26	In Progress
Task 3	Mike Johnson	2023-10-27	Pending
Task 4	Sarah Lee	2023-10-28	Not Started
Task 5	David Kim	2023-10-29	Completed
Task 6	Emily White	2023-10-30	In Progress
Task 7	Chris Brown	2023-10-31	Pending
Task 8	Alex Green	2023-11-01	Not Started
Task 9	Olivia Black	2023-11-02	Completed
Task 10	Noah Gray	2023-11-03	In Progress





















